

REMARKS

The present Amendment is responsive to the Official Action mailed August 18, 2010. A petition for a two-month extension of the term for response to said Official Action, to and including January 18, 2011, is transmitted herewith.

Claims 1, 3, 4, 6-12, 14-17, 19, and 21-30 are pending in the application. Claims 1, 3, 4, 6-12, 14-17, and 19 have been withdrawn from consideration, based on the Examiner's position that there is no special technical feature that is common to all of the claims, in view of the prior art applied in the Official Action. As discussed below, the applied prior art fails to teach or suggest at least one feature common to all of the claims. Therefore, all of the pending claims do possess unity of invention, and the withdrawn claims should now be examined for patentability.

A minor amendment to claim 21 has been made herein, in order to clarify the wording of the claim. In particular, the words "each of" before "said gas streams" have been removed, so it is clear that the plurality of gas streams flow with a "substantially uniform velocity," not that the velocity of "each" stream is "substantially uniform" along its length.

In view of the above amendments and following remarks, reconsideration of the Examiner's rejections is respectfully requested.

I. CLAIM REJECTIONS - 35 U.S.C. § 112

In the Official Action, the Examiner rejected claim 27 under 35 U.S.C. § 112, second paragraph, contending that the term "substantially proportional" renders the claim indefinite.

"The fact that claim language, including terms of degree, may not be precise, does not automatically render the claim indefinite under 35 U.S.C. § 112, second paragraph." Manual of Patent

Examining Procedure ("M.P.E.P."), 8th Ed., Rev. 8, § 2173.05(b) (*citing Seattle Box Co. v. Industrial Crating & Packing, Inc.*, 731 F.2d 818, 221 U.S.P.Q. 568 (Fed. Cir. 1984)). The M.P.E.P. acknowledges that "broadening modifiers are standard tools in claim drafting in order to avoid reliance on the doctrine of equivalents in infringement actions." *Id.* "Acceptability of the claim language depends on whether one of ordinary skill in the art would understand what is claimed, in light of the specification." *Id.* The M.P.E.P. specifically discusses the term "substantially" and several cases upholding that term as definite. See M.P.E.P. § 2173.05(b)(D). One of the cited cases involved the claim recitation "*substantially equal* E and H plane illumination patterns," and the court stated that terms such as "substantially equal" are "ubiquitous in patent claims. Such usages, when serving reasonably to describe the claimed subject matter to those of skill in the field of the invention, and to distinguish the claimed subject matter from the prior art, have been accepted in patent examination and upheld by the courts." *Andrew Corp. v. Gabriel Electronics*, 847 F.2d 819, 821, 6 U.S.P.Q.2d 2010, 2012 (Fed. Cir. 1988). In that case, the court held that the claim limitation was definite because one of ordinary skill in the art would know what was meant by "substantially equal." M.P.E.P. § 2173.05(b)(D).

In this case, a person having ordinary skill in the art would understand what is claimed by the claim language "the concentration of reactant gas in each stream is substantially proportional to the radial distance of the stream from said axis." In particular, it would be well understood that the above-recited claim language requires the concentration to be proportional to radial distance, while allowing for trivial deviations in concentration that do not

have an appreciable effect on the uniformity of the resulting deposited material.

Thus, the term "substantially proportional" does not render claim 27 indefinite, and it is respectfully requested that the Examiner withdraw the rejection under § 112.

II. CLAIM REJECTIONS - 35 U.S.C. § 102

Claims 21-24 and 27-30 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent Application Pub. No. 2002/0009868 to Tobashi *et al.* ("*Tobashi*").

Tobashi discloses a reactor and a trial-and-error method for growing a thin film having uniform thickness and uniform electric properties. The reactor B includes adjusting means 8, 9 (see FIG. 1) for adjusting the flow rate or the concentration of the reaction gas that is fed to gas feed ports 1, 2. The gas feed ports 1, 2 then feed the gases into respective concentric chambers radially separated by walls 7 and having flow stabilizer plates 3 on their downstream ends. The stabilizer plates 3 make the gas flow more uniform before it continues downwards towards the wafer substrate A. Each concentric chamber (*i.e.*, central and outer) is associated with a respective zone of the reactor.

Tobashi teaches gradually increasing or decreasing one or more of: the relative flow rates of the reaction gas between the concentric zones; the relative concentrations of the reaction gas between the zones; and the relative concentrations of the dopant between the zones. (See, *e.g.*, *Tobashi* ¶ [0049].) The one or more variables can be adjusted and the resulting films tested in a trial-and-error method of equalizing the film-forming rate and resistivity over the whole wafer substrate. (See exemplary test results in the Examples and Table 1.)

Tobashi teaches adjusting one or more of the above variables, but fails to teach or suggest having the gas streams flow within the chamber toward the substrate surfaces with a "substantially uniform velocity" and also such that "the gas streams flowing toward radially outward portions of said one or more surfaces have a higher concentration of said reactant gas than the gas streams flowing toward radially inward portions of said one or more surfaces" (emphasis added), as recited in independent claim 21. Indeed, *Tobashi* teaches that the relative concentrations of the reaction gas between the concentric zones can be either "increased or decreased" to equalize the film-forming rate over the whole wafer substrate. (*Tobashi* ¶ [0060] (emphasis added).) *Tobashi* states that the ratio of the concentrations between the central and outer zones can be somewhere in the range of 1:0.25 to 1:4 (i.e., the concentration of the gas in the central zone can be either higher or lower than the concentration of the gas in the outer zone). (*Id.* ¶ [0059].) This is far from an unambiguous teaching of providing a higher concentration of reactant gas at the radially outward portions of the substrate surfaces, as recited in the claim.

Moreover, nowhere does *Tobashi* teach or suggest maintaining the gas streams at a "uniform velocity" while the relative concentrations are adjusted. *Tobashi* refers to "flow rates." For example, *Tobashi* discusses the case of adjusting the relative gas concentrations between the different concentric zones while "the flow rate remains the same." (*Tobashi* ¶ [0059]). The "flow rates" referred to in *Tobashi* are the flow rates of the gas passing through the gas feed ports 1, 2 (FIGS. 1 and 2). (See, e.g., *id.* ¶¶ [0042], [0070].) These "flow rates" are not the velocities of the gas streams flowing within the processing chamber towards the

substrate. *Tobashi* does not say anything about the relative sizes of the concentric zones or the numbers (and sizes) of the holes in the plates 3 associated with each of the zones. For a given flow rate, these factors will determine the velocities of the resulting gas streams emanating from the stabilizer plates 3. Thus, even if the gas flow rates supplied by each of the gas feed ports 1, 2 were equalized, the velocities of the gas streams in each of the zones will not necessarily be the same.

In the Official Action, the Examiner contended that *Tobashi* "teaches making the velocity (momentum) of the gas so that it is substantially uniform, which is important in order to make the pressure uniform." (Official Action 3-4.) The portions of *Tobashi* referred to by the Examiner (*i.e.*, ¶¶ [0006]-[0007]) relate to the prior art reactor shown in FIG. 3, in which *Tobashi* describes the use of "flow stabilizer plates 3" "[i]n order to uniformize the momentum of the gases and the distribution of pressure." (*Tobashi* ¶ [0006].) However, the prior art reactor of FIG. 3 only includes one zone. The embodiments of the disclosed invention (see FIGS. 1 and 2), on the other hand, include multiple, individually supplied zones, each of which is associated with a different portion of the flow stabilizer plates 3. Thus, even if the stabilizer plates 3 uniformize the velocity of the gases within each zone, nowhere does *Tobashi* teach that gases in one zone should have the same velocity as the gases in another zone (see discussion above). In this regard, *Tobashi* does not appear to recognize (or teach a way of remedying) the turbulence that arises from injecting different velocity gas streams into a processing chamber. As discussed in the last paragraph of the Background of the Invention section of the present application, such turbulence can cause problems such as

uneven layer thickness, dissipation of reactant, and premature condensation of reactant.

Thus, *Tobashi* fails to teach or suggest all of the features recited in independent claim 21, and it is respectfully requested that the rejection of that claim be withdrawn. Additionally, due at least to the dependency of claims 22-24 and 27-30 from independent claim 21, the rejection of such dependent claims over *Tobashi* should also be withdrawn.

III. CLAIM REJECTIONS - 35 U.S.C. § 103

Dependent claim 25 was rejected under 35 U.S.C. § 103(a) as being obvious over *Tobashi* in view of U.S. Patent No. 4,980,204 to Fujii *et al.* ("*Fujii*"). Dependent claim 26 was rejected under § 103(a) as being obvious over *Tobashi* in view of U.S. Patent No. 4,010,045 to Ruehrwein ("*Ruehrwein*").

Neither *Fujii* nor *Ruehrwein* were relied on as teaching anything that would remedy the deficiencies of *Tobashi* discussed above with respect to claim 21. Therefore, due at least to the dependency of claims 25 and 26 from independent claim 21, the rejection of such dependent claims should be withdrawn.

IV. UNITY OF INVENTION

As discussed above with respect to independent claim 21, *Tobashi* fails to teach or suggest varying the concentration (or mass flow rate) of component reactant gas at different positions within a reactor and directing the mixed gases into the reactor with a substantially uniform velocity. Since this feature is included in all of the pending independent claims (*i.e.*, claims 1, 11, 17, 19, and 21), all of the claims possess unity of invention.

For example, independent claim 1 recites, *inter alia*, "wherein the one or more sources of reactant gas and the one or more sources

of carrier gas are configured such that the streams directed by said inlets have different concentrations of said reactant gas and different mass flow rates of said reactant gas but have substantially the same velocity." Similarly, independent claim 11 recites, *inter alia*, "said gas stream generator being configured such that the gas stream has substantially uniform velocity but different concentrations of a reactant gas at different radial distances from said axis." Independent claim 17 recites, *inter alia*, "said second combined gas stream having a second combined velocity substantially equal to said first combined velocity . . . said second treatment area unequal in area to said first treatment area . . . said reactant gas sources and said carrier gas sources being configured so that a ratio of said first reactant gas flow rate to said first treatment area is substantially equal to the ratio of said second reactant gas flow rate to said second treatment area." Claim 19 recites, *inter alia*, "gas supply means for introducing a reactant gas and a carrier gas . . . so that said gases flow . . . in one or more streams having substantially uniform velocity . . . wherein said gas supply means is operative to mix at least some of said reactant gas with said carrier gas so that gas flowing toward radially outward portions of said treatment surface has a higher concentration of said reactant gas than gas flowing toward radially inward portions of said treatment surface."

Accordingly, since all of the claims possess unity of invention, all of the claims (including the withdrawn claims) should be examined for patentability.

V. CONCLUSION

As it is believed that all of the rejections set forth in the Official Action have been fully met, favorable reconsideration and allowance are earnestly solicited.

If, however, for any reason the Examiner does not believe that such action can be taken at this time, it is respectfully requested that he telephone Applicants' attorney at (908) 654-5000 in order to overcome any additional objections which he might have.

If there are any additional charges in connection with this requested amendment, the Examiner is authorized to charge Deposit Account No. 12-1095 therefor.

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